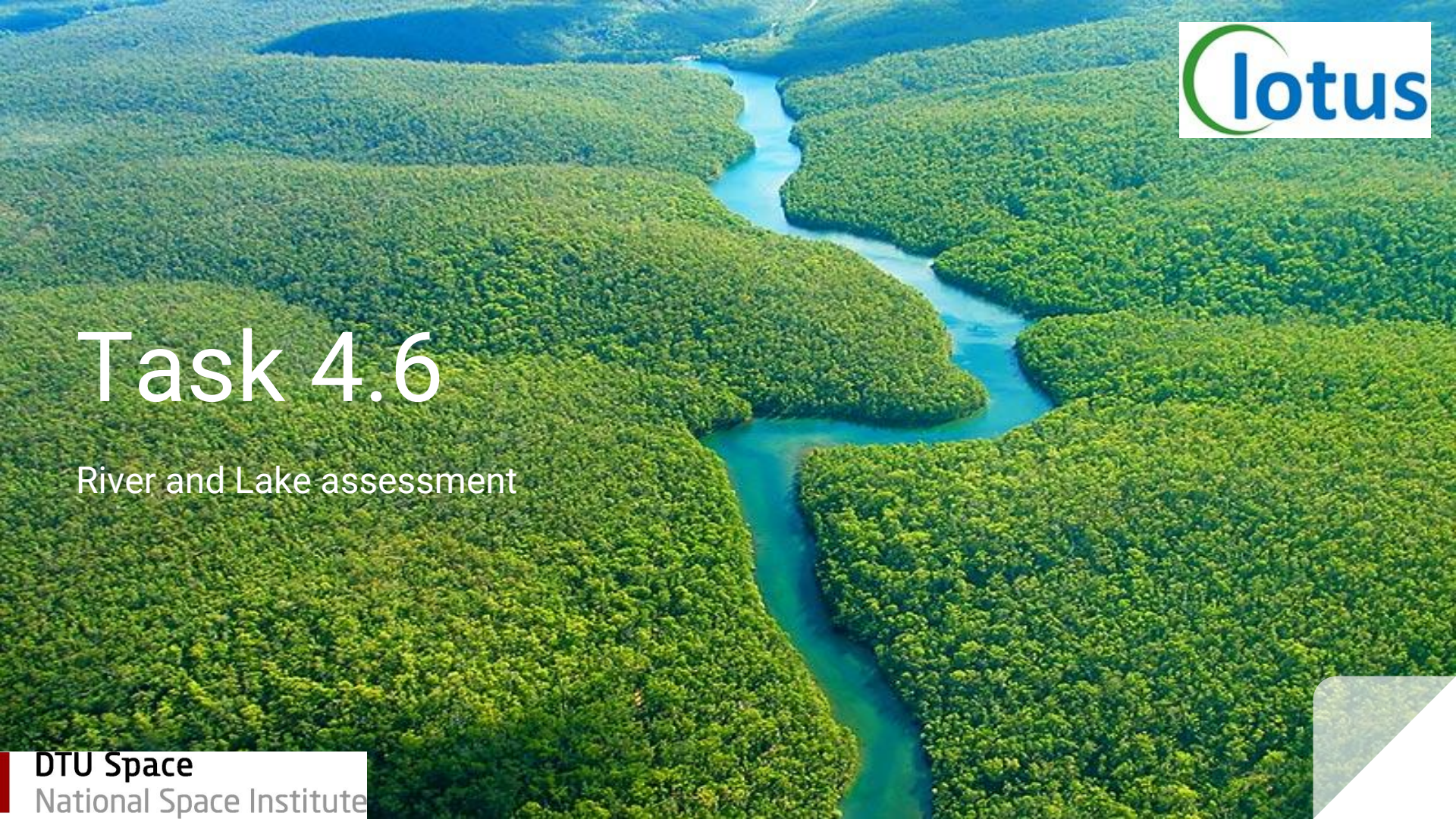


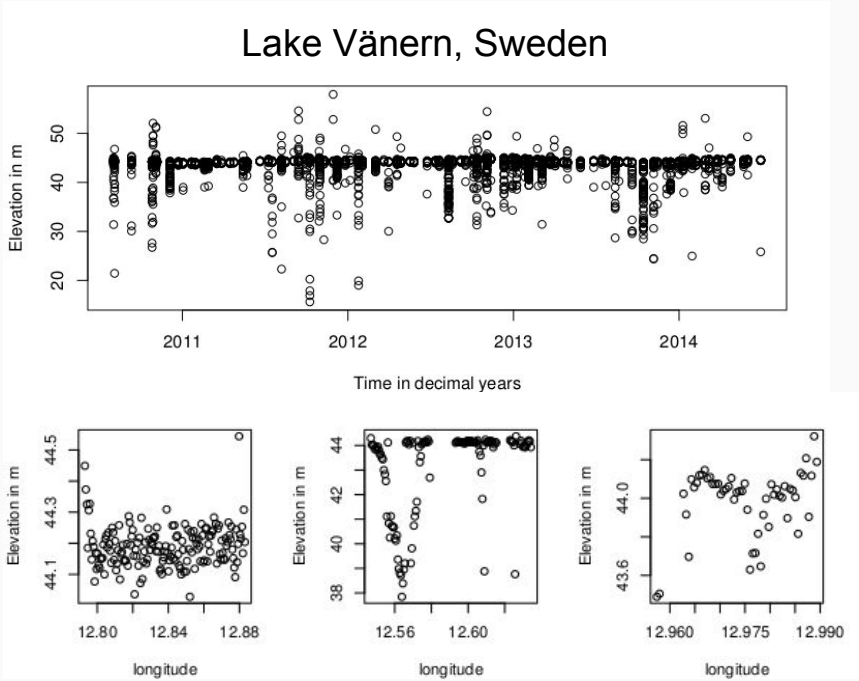
Task 4.6

River and Lake assessment

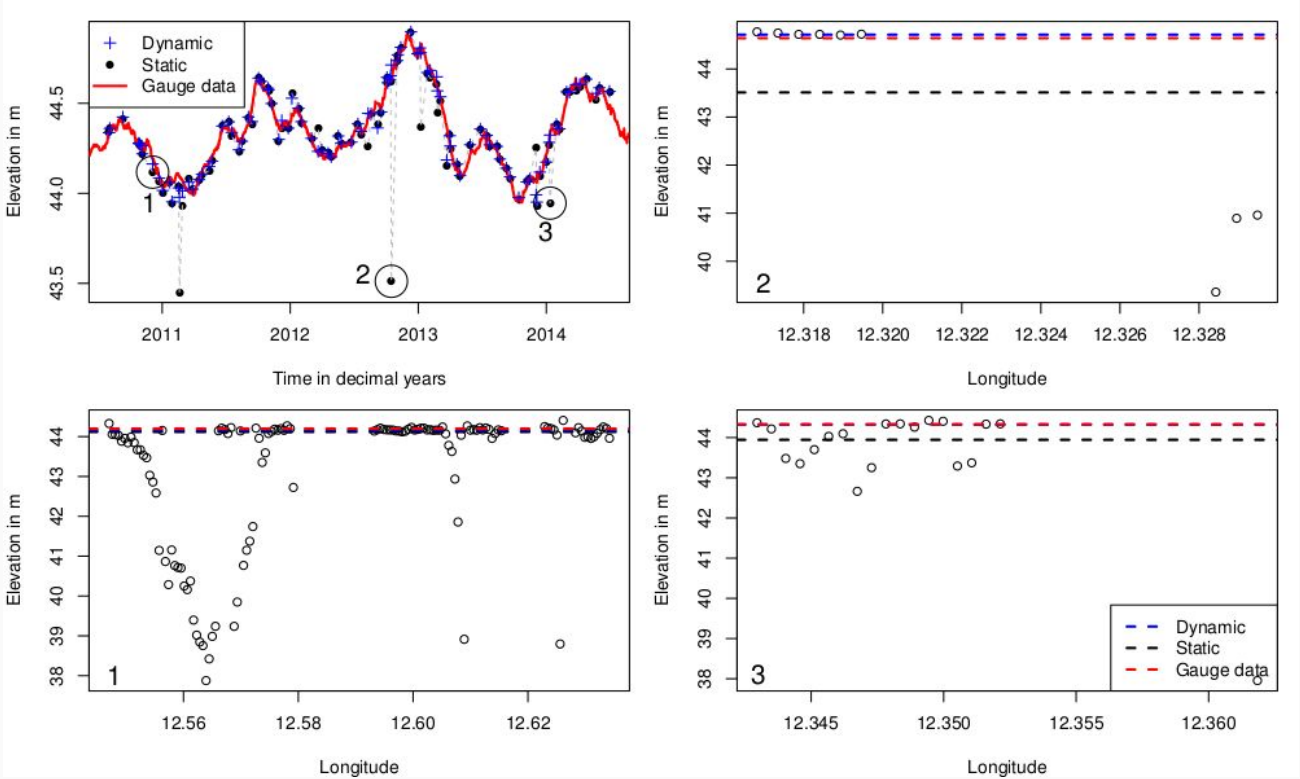
DTU Space
National Space Institute

Deriving time series

- The Obtained water levels might be erroneous
  - Land contamination of the waveform
    - Snagging
    - Topography
- We use a state-space model to construct the time series
  - Process model, simple random walk
  - Observation model $H^{obs}_{ij}=H^{true}_{i}+\sigma_{obs}\epsilon_{ij}$
  - The errors are assumed to follow a mixture distribution
- The model is implemented in the “R” package “TMB” http://tmb-project.org

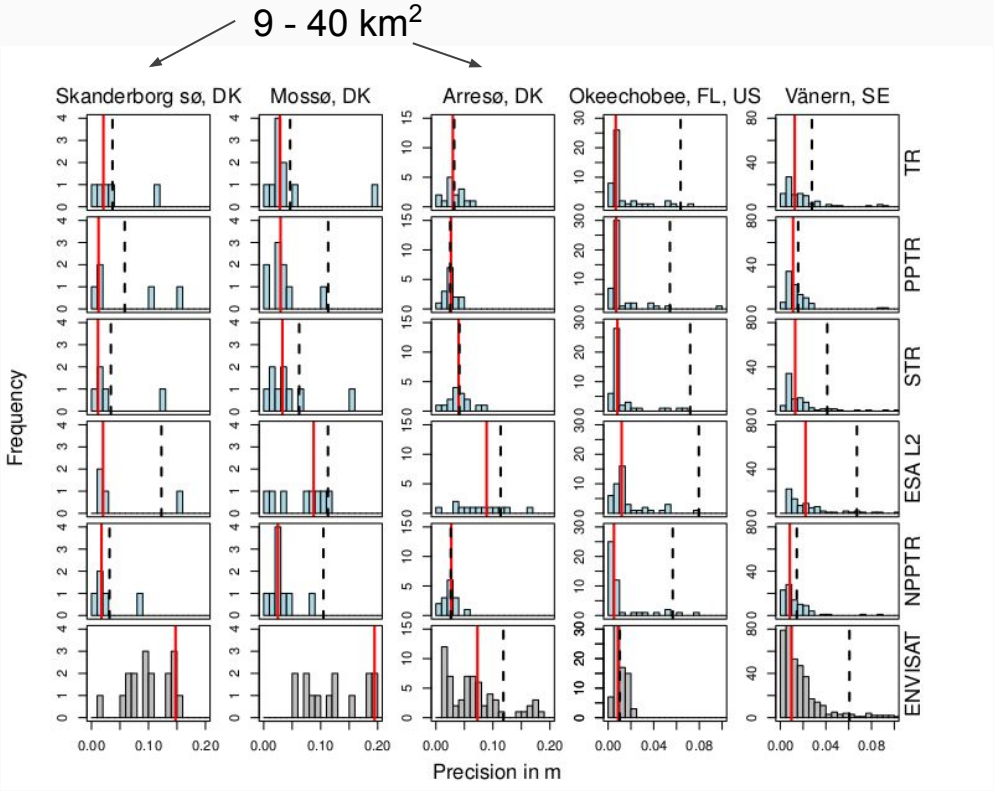


Lake Vänern Sweden, effect of the dynamic model



Danish lakes, precision

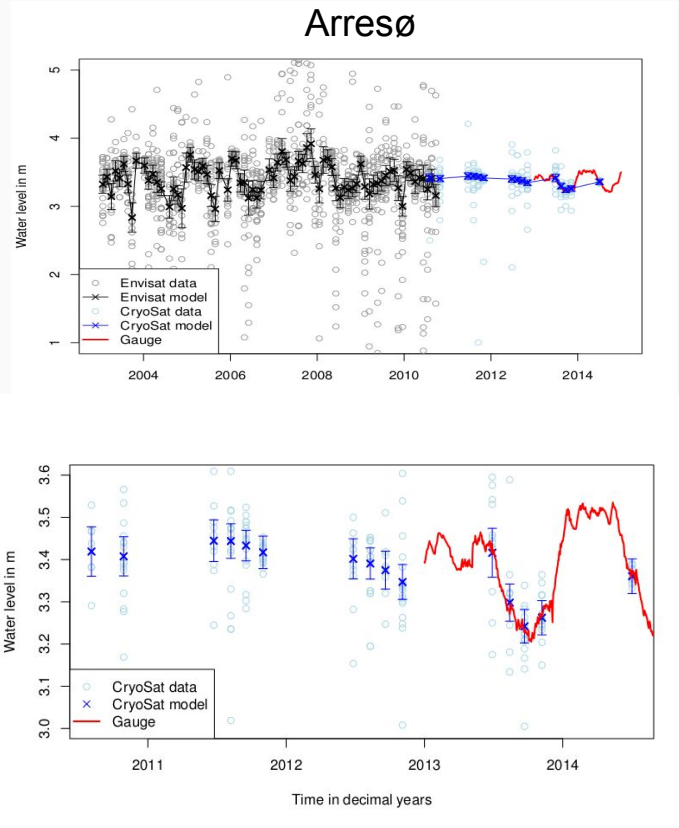
- The “precision” is here defined as the standard deviation of the along-track mean water level
- The precision of CryoSat-2 based water levels is just a few cm, even for small lakes



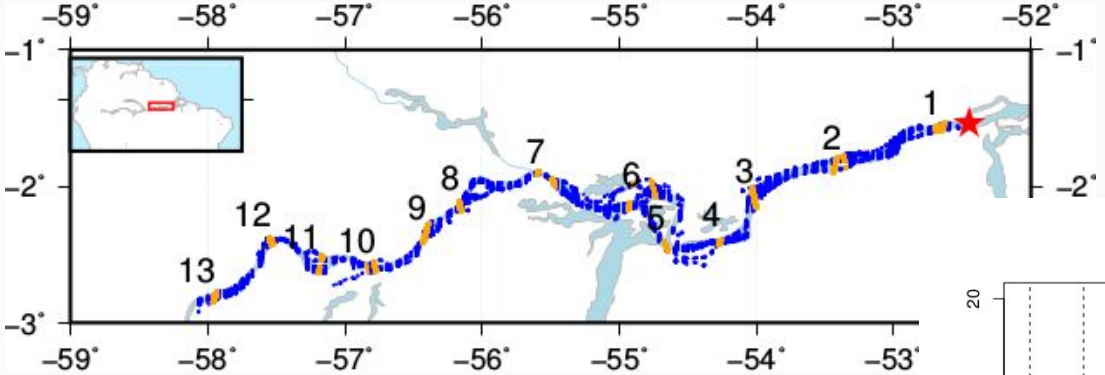
The red bar indicates the median of the precision distribution

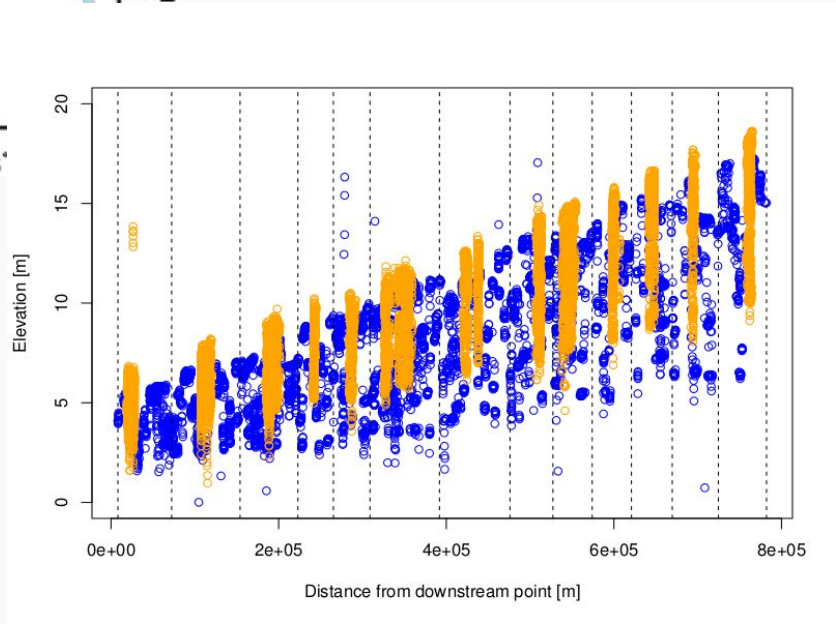
Arresø, CryoSat-2 compared with in-situ

- CryoSat-2 based water levels much more stable compared to Envisat
- After a bias correction the CryoSat-2 water levels fits the in-situ data within a few cm
  - The in-situ data and the CryoSat-2 water levels are in different height systems
  - The applied retracker may also introduce a bias
- With CryoSat-2 we are able to detect water level changes below the decimeter level in favorable (low topography) conditions



Amazon River

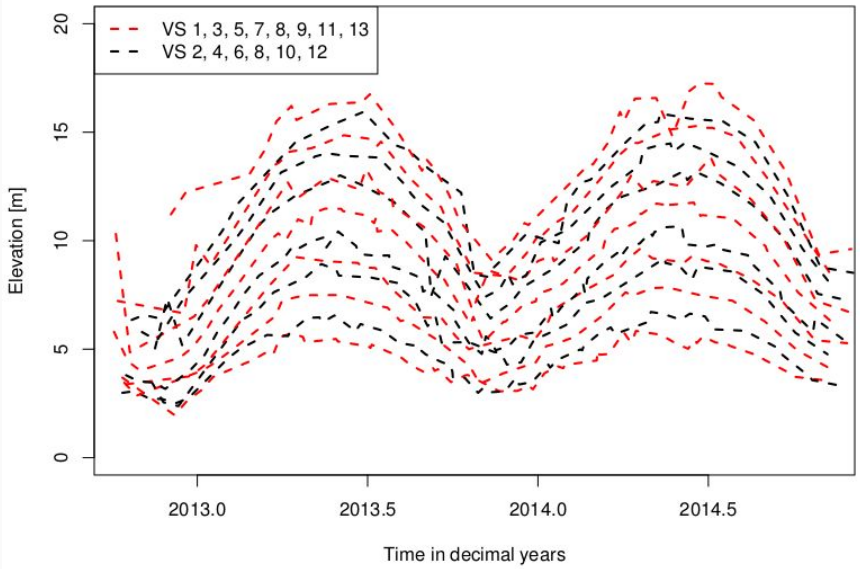




- The drifting track pattern of CryoSat-2 makes it more challenging to derive water level time series at virtual stations
- In some cases this can be solved with a linear slope correction

Water level time series at virtual stations

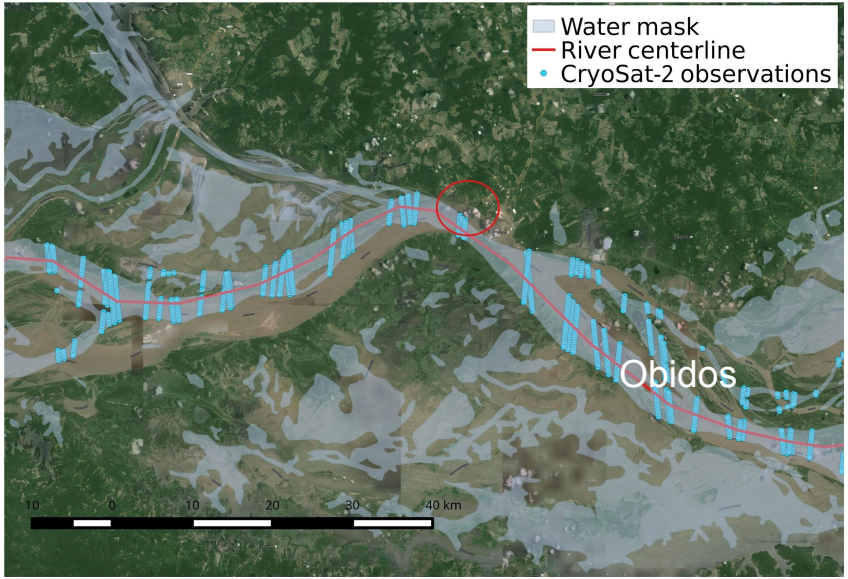
Time series at the virtual stations based on both CryoSat-2 and SARAL/AltiKa data

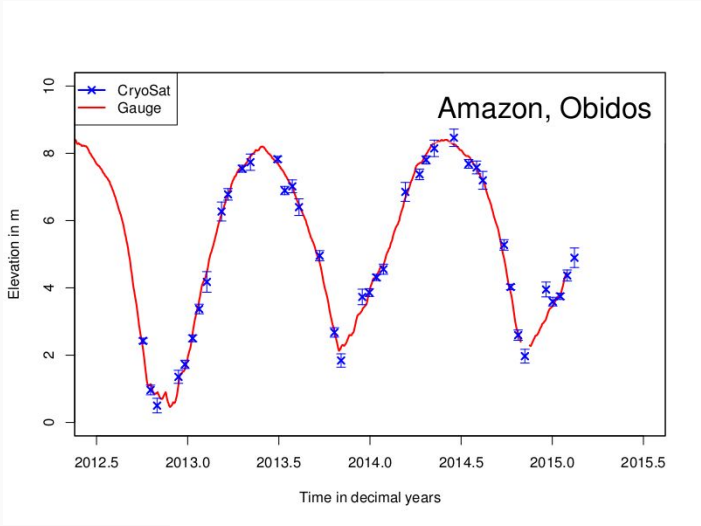


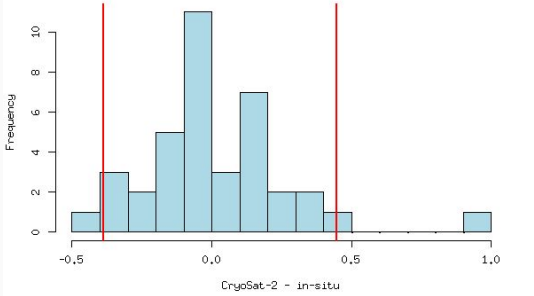
Virtual Station	CryoSat-2	SARAL/AltiKa	Virtual Station	CryoSat-2	SARAL/AltiKa
1	0.11	0.34	8	0.15	0.45
2	0.10	0.33	9	0.17	0.33
3	0.11	0.27	10	0.10	0.52
4	0.09	0.42	11	0.10	0.23
5	0.13	0.66	12	0.16	0.65
6	0.11	0.38	13	0.09	0.30
7	0.12	0.42			

Estimated measurement error at each virtual station

Amazon river, Obidos







- To derive time series, data is projected to the center line of the river and slope corrected. Approximately data within 40 km to each side of Obidos is used to construct the time series.